SO_2 Emission from Fuel Sulphur (mg/Nm³)

Uncontrolled SO_2 concentration in dry flue gas from the fuel's sulphur, analysis and excess air, at actual and reference O_2, for comparison with emission limits.

Method: Stoichiometry S + O_2 → SO_2 with the exact-ratio flue gas balance

Input parameters

Unit system: SI

Parameter	Value	Unit
Carbon	45.000	%
Hydrogen	3.5000	%
Oxygen	5.0000	%
Nitrogen	1.0000	%
Sulphur	0.50000	%
Ash	35.000	%
Moisture	10.000	%
Excess air	20.000	%
Air humidity (kg water per kg dry air)	0.013000	kg/kg
Reference O_2 of the emission limit (dry)	6.0000	%
O_2 in air used by the rule 20.95 % is the physical value; EU IED Annex VI and Indian practice write 21 %, US EPA Method 19 uses 20.9 %. Enter the value of the rule you report against.	20.950	%

Calculated results

Parameter	Value	Unit
SO_2 at reference O_2, dry, normal	1,538.1	mg/Nm³
SO_2 at actual O_2, dry, normal	1,786.4	mg/Nm³
Actual O_2 in dry flue gas	3.5863	%
SO_2 per kg of fuel	9.9903	g/kg
Dry flue gas per kg of fuel	5.5924	Nm³/kg

Notes for this case

- All fuel sulphur is taken to leave as SO_2; sulphur retained in ash (notable with high-calcium ash or limestone) lowers it.

Formula and method

$$m_{SO_2} = S\,\frac{M_{SO_2}}{M_S} \qquad c = \frac{m_{SO_2}}{V_{dg}} \qquad c_{ref} = c\,\frac{O_{2,air} - O_{2,ref}}{O_{2,air} - O_2}$$

Variables

C, H, O, N, S, A, M	ultimate analysis as fired	–
EA	excess air	–
ω	air humidity	kg/kg
$O_{2,ref}$	reference O_2 (dry)	–
$O_{2,air}$	O_2 in air used by the rule (20.95 % physical; 21 % EU IED and Indian practice; 20.9 % US EPA)	–
c_{ref}	SO_2 at reference O_2	kg/m³
c	SO_2 at actual O_2	kg/m³

O_2	actual O_2 in dry flue gas	–
m_{SO_2}	SO_2 per kg fuel	kg/kg
V_{dg}	dry flue gas per kg fuel at normal conditions	m^3/kg
M_{SO_2}, M_S	molar masses	kg/kmol

Method and standards

Exact-ratio combustion balance with all fuel sulphur as SO_2; dry gas volume at 0 °C and 101.325 kPa; O_2 correction to the reference.

Assumptions and limits

- All sulphur to SO_2 (SO_3 and ash retention neglected); complete combustion.

References

- Stoichiometry S + O_2 → SO_2 with the exact-ratio flue gas balance

Report details

Report reference	FCC-EJZB-T54S (the same inputs always give the same reference)
Generated	17 November 2026, 19:36 UTC
Calculator	SO_2 Emission from Fuel Sulphur (mg/Nm^3)
Method last reviewed	11 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/boilers-power-plant/emissions-stacks/fuel-sulphur-so2

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.